

MOSFETs Silicon P-Channel MOS (U-MOSVI)

# SSM6J422TU

## 1. Applications

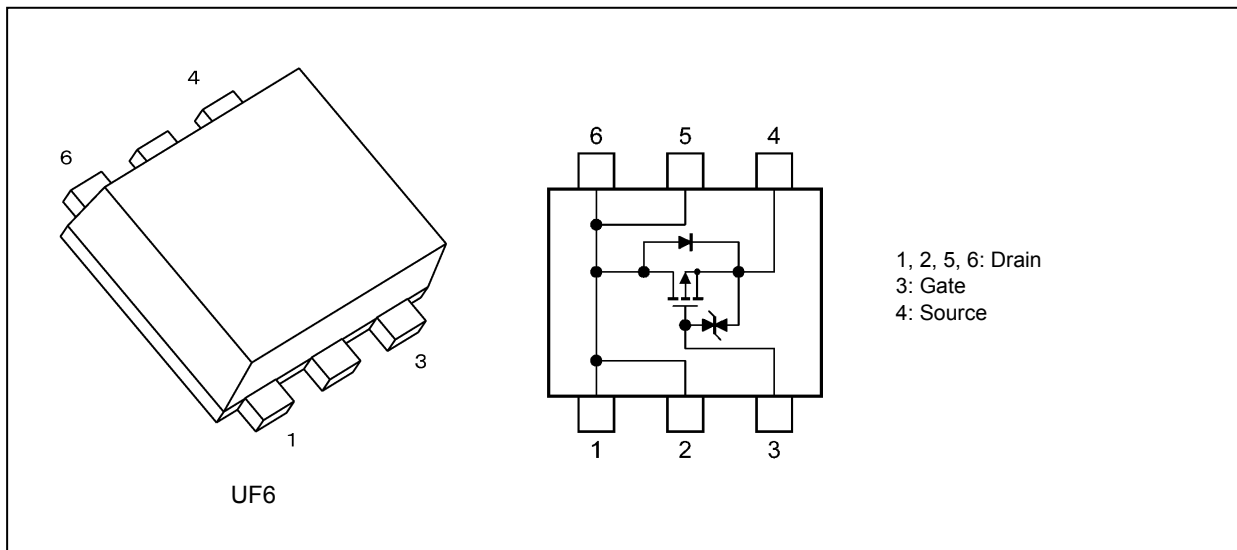
- Power Management Switches

## 2. Features

- (1) AEC-Q101 qualified (Note 1)
- (2) 1.5-V gate drive voltage.
- (3) Low drain-source on-resistance
  - :  $R_{DS(ON)} = 99.6 \text{ m}\Omega$  (max) (@ $V_{GS} = -1.5 \text{ V}$ )
  - $R_{DS(ON)} = 67.8 \text{ m}\Omega$  (max) (@ $V_{GS} = -1.8 \text{ V}$ )
  - $R_{DS(ON)} = 51.4 \text{ m}\Omega$  (max) (@ $V_{GS} = -2.5 \text{ V}$ )
  - $R_{DS(ON)} = 42.7 \text{ m}\Omega$  (max) (@ $V_{GS} = -4.5 \text{ V}$ )

Note 1: For detail information, please contact to our sales.

## 3. Packaging and Pin Configuration



## 4. Absolute Maximum Ratings (Note) (Unless otherwise specified, $T_a = 25^{\circ}\text{C}$ )

| Characteristics                   | Symbol           | Rating     | Unit               |
|-----------------------------------|------------------|------------|--------------------|
| Drain-source voltage              | $V_{\text{DSS}}$ | -20        | V                  |
| Gate-source voltage               | $V_{\text{GSS}}$ | -8/+6      |                    |
| Drain current (DC) (Note 1)       | $I_{\text{D}}$   | -4         | A                  |
| Drain current (pulsed) (Note 1,2) | $I_{\text{DP}}$  | -16        |                    |
| Power dissipation (Note 3)        | $P_{\text{D}}$   | 1          | W                  |
| Channel temperature               | $T_{\text{ch}}$  | 150        | $^{\circ}\text{C}$ |
| Storage temperature               | $T_{\text{stg}}$ | -55 to 150 |                    |

Note: Using continuously under heavy loads (e.g. the application of high temperature/current/voltage and the significant change in temperature, etc.) may cause this product to decrease in the reliability significantly even if the operating conditions (i.e. operating temperature/current/voltage, etc.) are within the absolute maximum ratings.

Please design the appropriate reliability upon reviewing the Toshiba Semiconductor Reliability Handbook ("Handling Precautions"/"Derating Concept and Methods") and individual reliability data (i.e. reliability test report and estimated failure rate, etc).

Note 1: Ensure that the channel temperature does not exceed  $150^{\circ}\text{C}$ .

Note 2: Pulse width (PW)  $\leq 10\ \mu\text{s}$ , duty  $\leq 1\%$

Note 3: Device mounted on an FR4 board.(25.4 mm  $\times$  25.4 mm  $\times$  1.6 mm, Cu Pad: 645 mm<sup>2</sup>)

Note: The MOSFETs in this device are sensitive to electrostatic discharge. When handling this device, the worktables, operators, soldering irons and other objects should be protected against anti-static discharge.

Note: The channel-to-ambient thermal resistance,  $R_{\text{th(ch-a)}}$ , and the power dissipation,  $P_{\text{D}}$ , vary according to the board material, board area, board thickness and pad area. When using this device, be sure to take heat dissipation fully into account.

## 5. Electrical Characteristics

### 5.1. Static Characteristics ( $T_a = 25^\circ\text{C}$ unless otherwise specified)

| Characteristics                         | Symbol        | Test Condition                                    | Min  | Typ. | Max     | Unit             |
|-----------------------------------------|---------------|---------------------------------------------------|------|------|---------|------------------|
| Gate leakage current                    | $I_{GSS}$     | $V_{GS} = -8/+6\text{ V}$ , $V_{DS} = 0\text{ V}$ | —    | —    | $\pm 1$ | $\mu\text{A}$    |
| Drain cut-off current                   | $I_{DSS}$     | $V_{DS} = -20\text{ V}$ , $V_{GS} = 0\text{ V}$   | —    | —    | -1      |                  |
| Drain-source breakdown voltage          | $V_{(BR)DSS}$ | $I_D = -1\text{ mA}$ , $V_{GS} = 0\text{ V}$      | -20  | —    | —       | V                |
| Drain-source breakdown voltage (Note 1) | $V_{(BR)DSX}$ | $I_D = -1\text{ mA}$ , $V_{GS} = 5\text{ V}$      | -15  | —    | —       |                  |
| Gate threshold voltage (Note 2)         | $V_{th}$      | $V_{DS} = -3\text{ V}$ , $I_D = -1\text{ mA}$     | -0.3 | —    | -1.0    |                  |
| Drain-source on-resistance (Note 3)     | $R_{DS(ON)}$  | $I_D = -3.0\text{ A}$ , $V_{GS} = -4.5\text{ V}$  | —    | 36.9 | 42.7    | $\text{m}\Omega$ |
|                                         |               | $I_D = -2.5\text{ A}$ , $V_{GS} = -2.5\text{ V}$  | —    | 42.8 | 51.4    |                  |
|                                         |               | $I_D = -1.5\text{ A}$ , $V_{GS} = -1.8\text{ V}$  | —    | 50.6 | 67.8    |                  |
|                                         |               | $I_D = -0.5\text{ A}$ , $V_{GS} = -1.5\text{ V}$  | —    | 58.6 | 99.6    |                  |
| Forward transfer admittance (Note 3)    | $ Y_{fs} $    | $V_{DS} = -3\text{ V}$ , $I_D = -1.0\text{ A}$    | 4.5  | 9.1  | —       | S                |

Note 1: If a reverse bias is applied between gate and source, this device enters  $V_{(BR)DSX}$  mode. Note that the drain-source breakdown voltage is lowered in this mode.

Note 2: Let  $V_{th}$  be the voltage applied between gate and source that causes the drain current ( $I_D$ ) to below (-1 mA for this device). Then, for normal switching operation,  $V_{GS(ON)}$  must be higher than  $V_{th}$ , and  $V_{GS(OFF)}$  must be lower than  $V_{th}$ . This relationship can be expressed as:  $V_{GS(OFF)} < V_{th} < V_{GS(ON)}$ .

Take this into consideration when using the device.

Note 3: Pulse measurement.

### 5.2. Dynamic Characteristics ( $T_a = 25^\circ\text{C}$ unless otherwise specified)

| Characteristics                | Symbol    | Test Condition                                                                                                                                                                                                  | Min | Typ. | Max | Unit        |
|--------------------------------|-----------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----|------|-----|-------------|
| Input capacitance              | $C_{iss}$ | $V_{DS} = -10\text{ V}$ , $V_{GS} = 0\text{ V}$ ,<br>$f = 1\text{ MHz}$                                                                                                                                         | —   | 840  | —   | $\text{pF}$ |
| Reverse transfer capacitance   | $C_{rss}$ |                                                                                                                                                                                                                 | —   | 99   | —   |             |
| Output capacitance             | $C_{oss}$ |                                                                                                                                                                                                                 | —   | 118  | —   |             |
| Switching time (turn-on time)  | $t_{on}$  | $V_{DD} = -10\text{ V}$ , $I_D = -2.0\text{ A}$<br>$V_{GS} = 0\text{ to }-2.5\text{ V}$ , $R_G = 4.7\text{ }\Omega$ ,<br>Duty $\leq 1\%$ , Input: $t_r$ , $t_f < 5\text{ ns}$<br>Common source, See Chapter 5.3 | —   | 32   | —   | ns          |
| Switching time (turn-off time) | $t_{off}$ |                                                                                                                                                                                                                 | —   | 107  | —   |             |

### 5.3. Switching Time Test Circuit

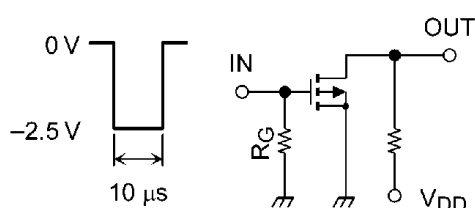


Fig. 5.3.1 Test Circuit of Switching Time

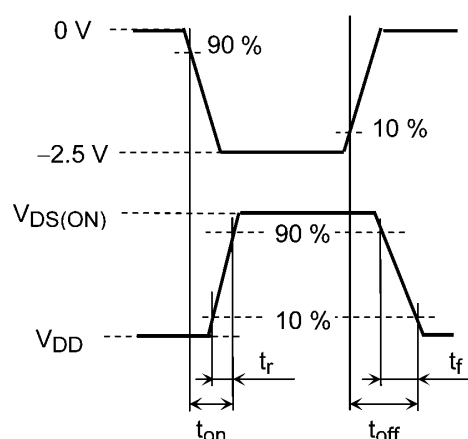


Fig. 5.3.2 Input Waveform/Output Waveform

5.4. Gate Charge Characteristics (T<sub>a</sub> = 25°C unless otherwise specified)

| Characteristics                                 | Symbol           | Test Condition                                                                | Min | Typ. | Max | Unit |
|-------------------------------------------------|------------------|-------------------------------------------------------------------------------|-----|------|-----|------|
| Total gate charge (gate-source plus gate-drain) | Q <sub>g</sub>   | V <sub>DD</sub> = -10 V, V <sub>GS</sub> = -4.5 V,<br>I <sub>D</sub> = -4.0 A | —   | 12.8 | —   | nC   |
| Gate-source charge 1                            | Q <sub>gs1</sub> |                                                                               | —   | 1.4  | —   |      |
| Gate-drain charge                               | Q <sub>gd</sub>  |                                                                               | —   | 3.0  | —   |      |

5.5. Source-Drain Characteristics (T<sub>a</sub> = 25°C unless otherwise specified)

| Characteristics                | Symbol           | Test Condition                                | Min | Typ. | Max | Unit |
|--------------------------------|------------------|-----------------------------------------------|-----|------|-----|------|
| Diode forward voltage (Note 1) | V <sub>DSF</sub> | I <sub>D</sub> = 4.0 A, V <sub>GS</sub> = 0 V | —   | 0.88 | 1.2 | V    |

Note 1: Pulse measurement.

6. Marking

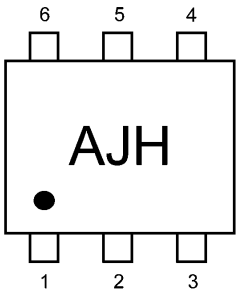


Fig. 6.1 Marking

## 7. Characteristics Curves (Note)

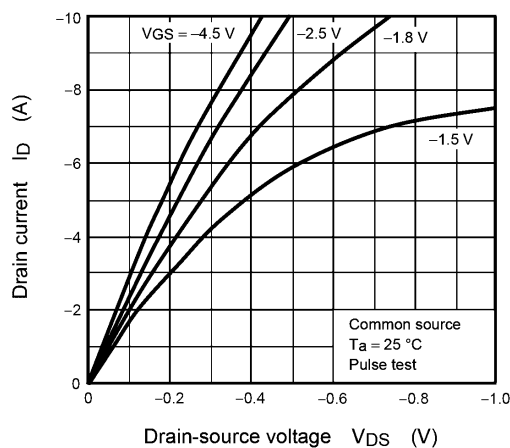


Fig. 7.1  $I_D - V_{DS}$

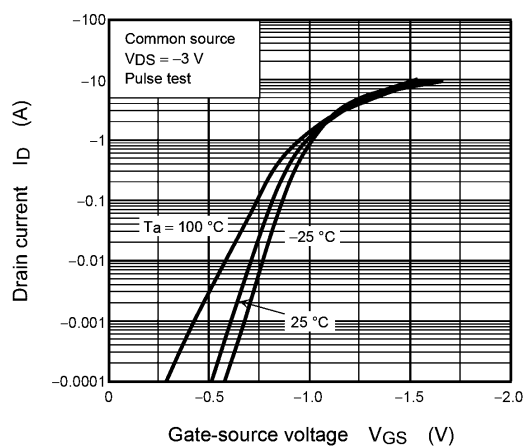


Fig. 7.2  $I_D - V_{GS}$

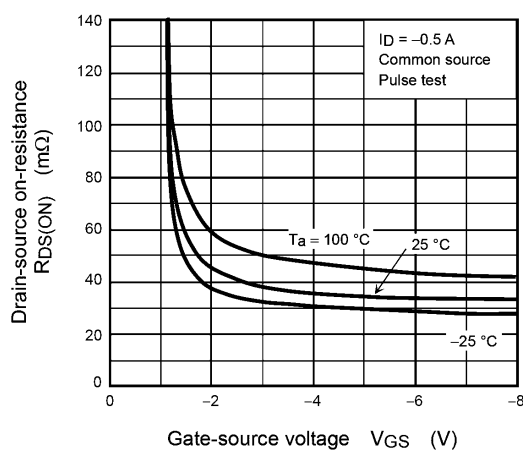


Fig. 7.3  $R_{DS(ON)} - V_{GS}$

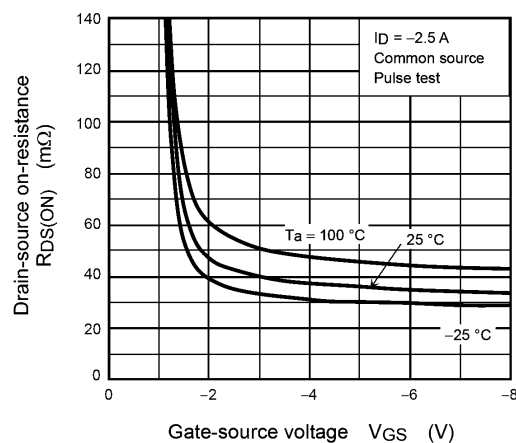


Fig. 7.4  $R_{DS(ON)} - V_{GS}$

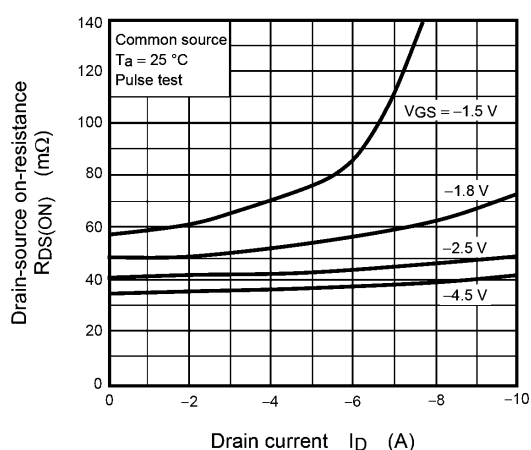


Fig. 7.5  $R_{DS(ON)} - I_D$

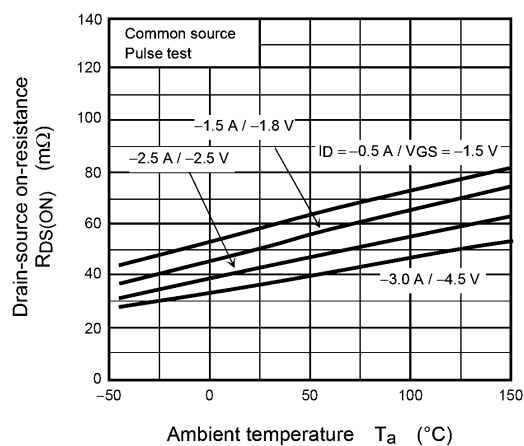


Fig. 7.6  $R_{DS(ON)} - T_a$

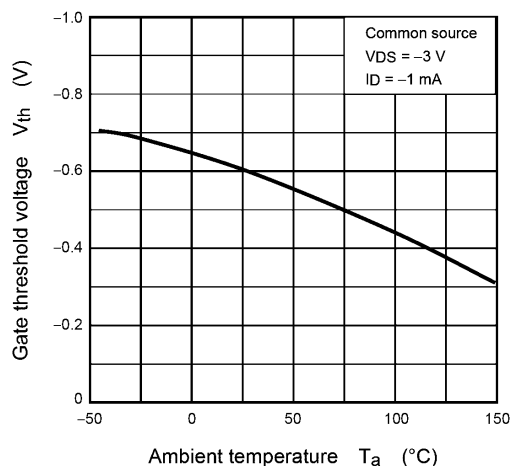


Fig. 7.7  $V_{th} - T_a$

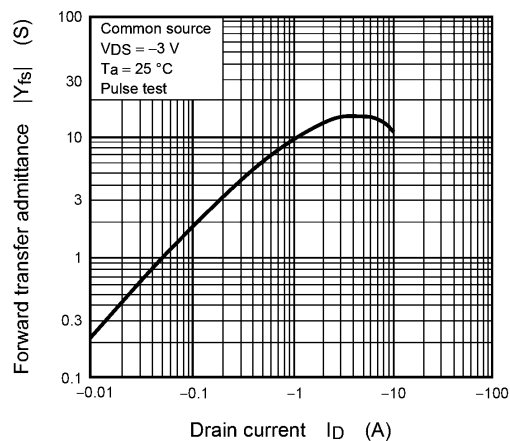


Fig. 7.8  $|Y_{fs}| - I_D$

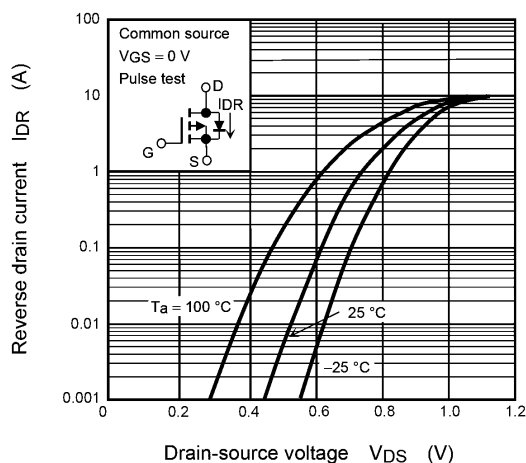


Fig. 7.9  $I_{DR} - V_{DS}$

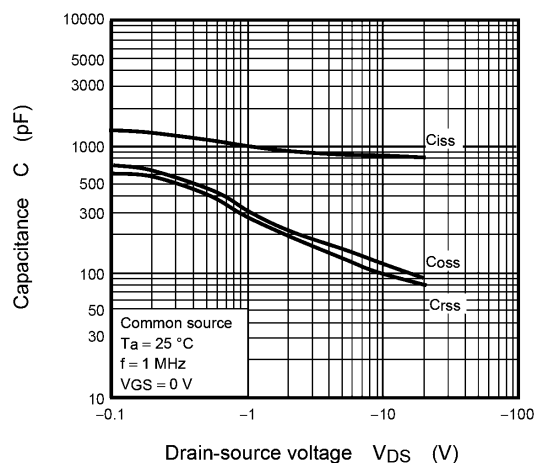


Fig. 7.10  $C - V_{DS}$

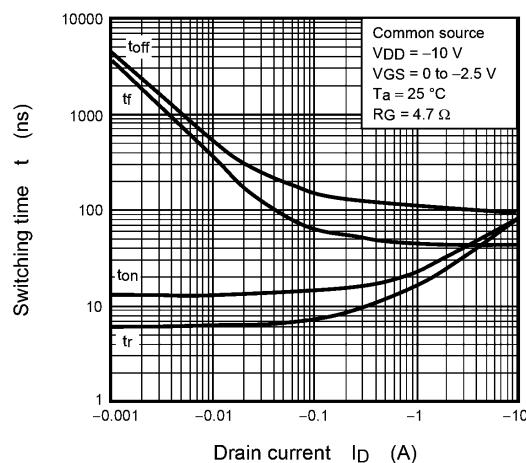


Fig. 7.11  $t - I_D$

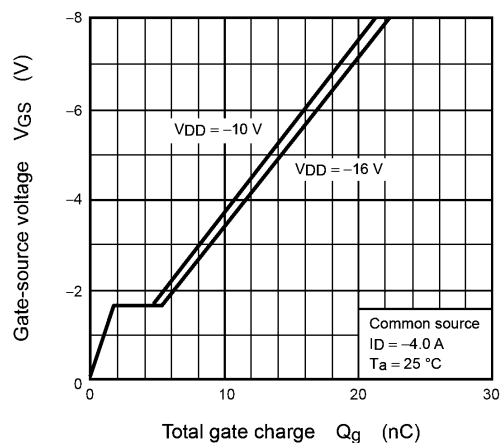


Fig. 7.12 Dynamic Input Characteristics

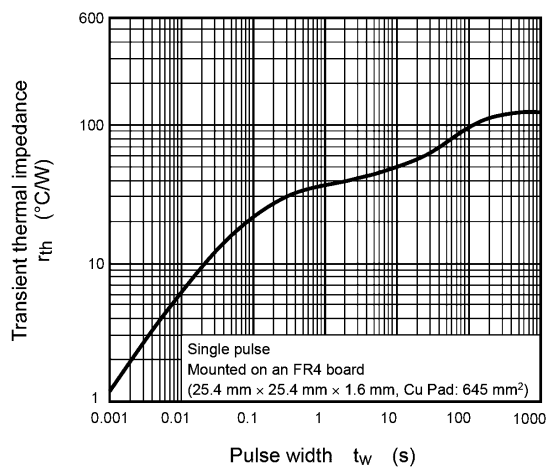


Fig. 7.13  $r_{th} - t_w$

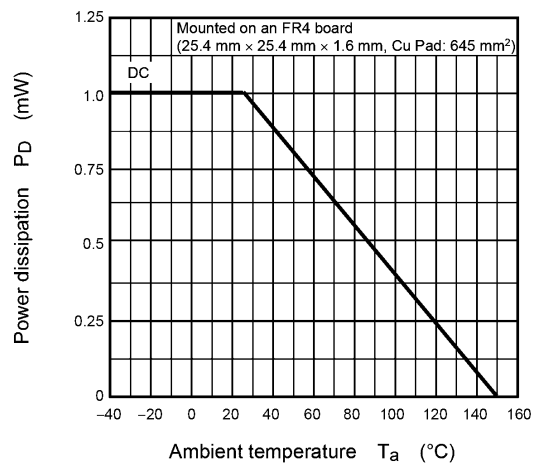
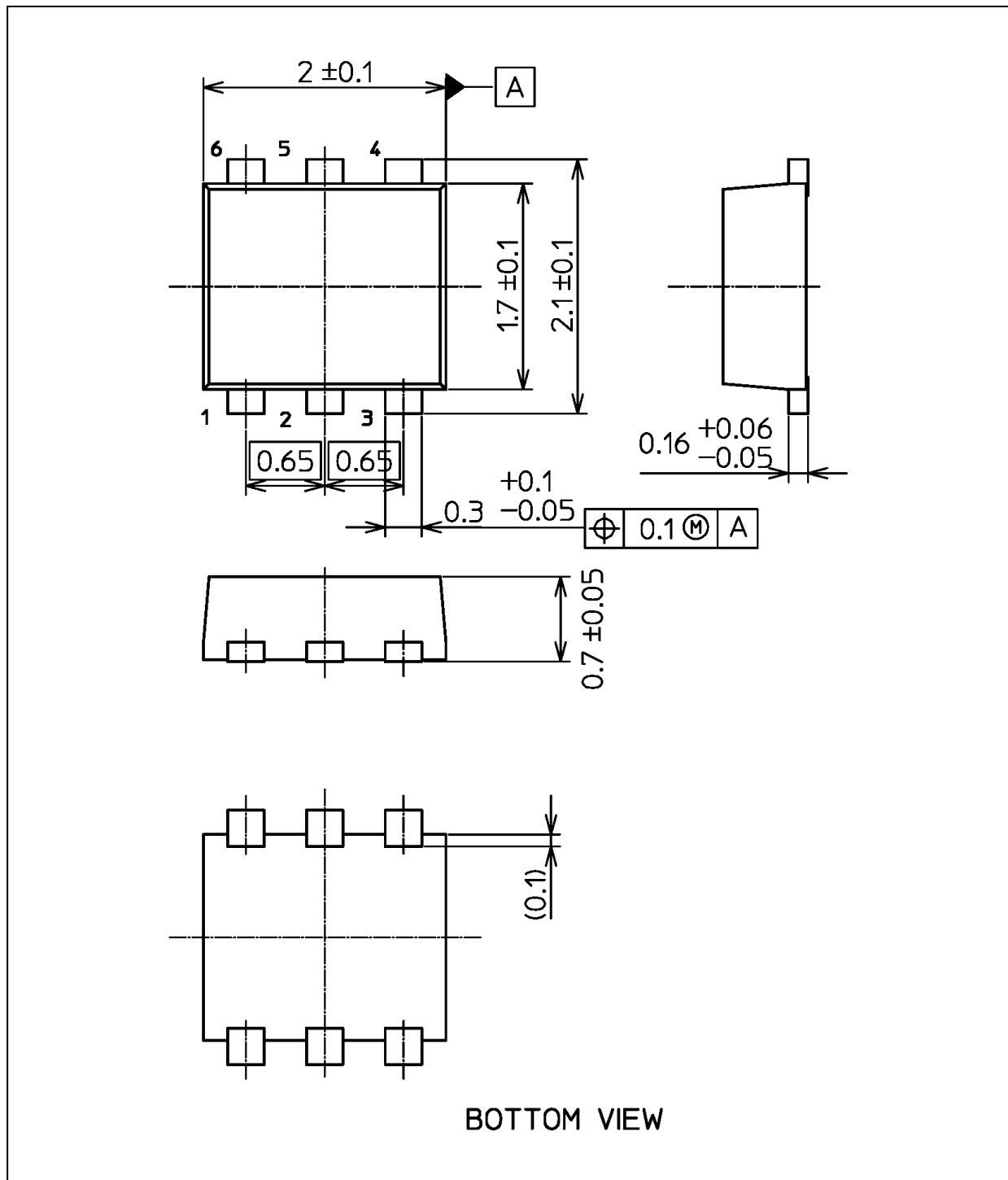


Fig. 7.14  $P_D - T_a$

Note: The above characteristics curves are presented for reference only and not guaranteed by production test, unless otherwise noted.

## Package Dimensions

Unit: mm



Weight: 7.0 mg (typ.)

| Package Name(s) |
|-----------------|
| TOSHIBA: 2-2T1S |
| Nickname: UF6   |



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